

**WHAT IS CLAIMED IS:**

1. A method for forming an antimicrobially-treated fabric, said method comprising:

forming a solution from a liquid and an antimicrobial agent;

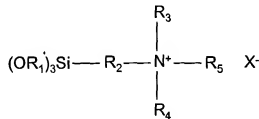
combining a cellulosic fibrous material with said solution to form a liquid suspension, wherein said antimicrobial agent becomes substantive to said cellulosic fibrous material after being combined therewith; and

forming a web from said liquid suspension of said antimicrobially-treated cellulosic fibrous material such that substantially all of the cellulosic fibrous material present within said web is derived from said antimicrobially-treated cellulosic fibrous material.

2. A method as defined in claim 1, wherein at least a portion of said liquid from said liquid suspension is removed during formation of said web, said removed liquid portion being substantially free from said antimicrobial agent.

3. A method as defined in claim 1, wherein said antimicrobial agent is an organosilicone quaternary ammonium compound.

4. A method as defined in claim 3, wherein said organosilicone quaternary ammonium compound has the following structure:



wherein,

R<sub>1</sub> is hydrogen or a C<sub>1</sub>-C<sub>8</sub> alkyl group;

R<sub>2</sub> is hydrogen or a C<sub>1</sub>-C<sub>8</sub> alkyl group;

R<sub>3</sub> and R<sub>4</sub> are the same or different, and are selected from the group consisting of hydrogen and a C<sub>1</sub>-C<sub>4</sub> alkyl group;

R<sub>5</sub> is hydrogen or a C<sub>1</sub>-C<sub>30</sub> alkyl group; and

X<sup>-</sup> is a suitable counterion.

5           5. A method as defined in claim 1, wherein said antimicrobial agent is 3-(trimethoxysilyl)propyloctadecyldimethyl ammonium chloride.

          6. A method as defined in claim 1, wherein said antimicrobial agent is hydrolyzed prior to forming said solution.

          7. A method as defined in claim 1, wherein said solution and said cellulosic fibrous material are combined in a pulper.

10          8. A method as defined in claim 7, wherein said solution and said cellulosic fibrous material are subjected to agitation while in said pulper.

          9. A method as defined in claim 1, wherein said antimicrobial agent is present in an amount between about 0.04% to about 1.0% by weight of said antimicrobially-treated cellulosic fibrous material.

15          10. A method as defined in claim 1, wherein said antimicrobial agent is present in an amount between about 0.2% to about 0.5% by weight of said antimicrobially-treated cellulosic fibrous material.

          11. A method as defined in claim 1, wherein said cellulosic fibrous material comprises high-average length pulp fibers, low-average length pulp fibers, or mixtures thereof.

20          12. A method as defined in claim 1, further comprising hydraulically entangling said web of antimicrobially-treated fibrous material with a nonwoven substrate.

          13. A method as defined in claim 12, wherein said nonwoven substrate is formed from continuous filaments.

25          14. A method as defined in claim 13, wherein said continuous filaments are formed by a spunbond process.

          15. A method as defined in claim 1, further comprising drying said web so that said antimicrobial agent forms a covalent bond with said cellulosic fibrous material.

16. A method as defined in claim 15, wherein said antimicrobial agent is an organosilicone compound such that said covalent bond is a siloxane bond.

5 17. A method for forming an antimicrobially-treated fabric, said method comprising:

forming a solution from a liquid and an antimicrobial agent, said antimicrobial agent being an organosilicone quaternary ammonium compound;

10 combining pulp fibers with said solution to form a liquid suspension while under agitation, wherein said organosilicone quaternary ammonium compound becomes substantive to said pulp fibers after being combined therewith;

forming a web from said liquid suspension of said antimicrobially-treated cellulosic fibrous material such that substantially all of the  
15 cellulosic fibrous material present within said web is derived from said antimicrobially-treated cellulosic fibrous material

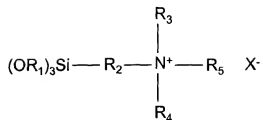
hydraulically entangling said web of antimicrobially-treated pulp fibers with a nonwoven substrate; and

20 drying said web so that said antimicrobial agent forms a covalent bond with pulp fibers.

18. A method as defined in claim 17, wherein said covalent bond is a siloxane bond.

19. A method as defined in claim 17, wherein at least a portion of said liquid from said liquid suspension is removed during formation of said  
25 web, said removed liquid portion being substantially free from said antimicrobial agent.

20. A method as defined in claim 17, wherein said organosilicone quaternary ammonium compound has the following structure:



wherein,

R<sub>1</sub> is hydrogen or a C<sub>1</sub>-C<sub>8</sub> alkyl group;

R<sub>2</sub> is hydrogen or a C<sub>1</sub>-C<sub>8</sub> alkyl group;

R<sub>3</sub> and R<sub>4</sub> are the same or different, and are selected from the group consisting of hydrogen and a C<sub>1</sub>-C<sub>4</sub> alkyl group;

R<sub>5</sub> is hydrogen or a C<sub>1</sub>-C<sub>30</sub> alkyl group; and

X<sup>-</sup> is a suitable counterion.

21. A method as defined in claim 17, wherein said antimicrobial agent is 3-(trimethoxysilyl)propyloctadecyldimethyl ammonium chloride.

22. A method as defined in claim 17, wherein said solution and said pulp fibers are combined in a pulper.

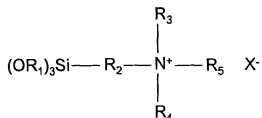
23. A method as defined in claim 17, wherein said nonwoven substrate is formed from continuous filaments.

24. A method as defined in claim 23, wherein said continuous filaments are formed by a spunbond process.

25. An antimicrobially-treated composite fabric comprising a nonwoven continuous filament substrate hydraulically entangled with pulp fibers, wherein substantially all of the pulp fibers present within the composite material are treated with an organosilicone antimicrobial agent.

26. An antimicrobially-treated composite fabric as defined in claim 25, wherein said antimicrobial agent is an organosilicone quaternary ammonium compound.

27. An antimicrobially-treated composite fabric as defined in claim 25, wherein said organosilicone quaternary ammonium compound has the following structure:



5            wherein,

$\text{R}_1$  is hydrogen or a  $\text{C}_1\text{-C}_8$  alkyl group;

$\text{R}_2$  is hydrogen or a  $\text{C}_1\text{-C}_8$  alkyl group;

$\text{R}_3$  and  $\text{R}_4$  are the same or different, and are selected from the group consisting of hydrogen and a  $\text{C}_1\text{-C}_4$  alkyl group;

10            $\text{R}_5$  is hydrogen or a  $\text{C}_1\text{-C}_{30}$  alkyl group; and

$\text{X}^-$  is a suitable counterion.

28. An antimicrobially-treated composite fabric as defined in claim 25, wherein said antimicrobial agent is 3-(trimethoxysilyl)propyloctadecyldimethyl ammonium chloride.

15           29. An antimicrobially-treated composite fabric as defined in claim 25, wherein said organosilicone antimicrobial agent comprises between about 0.04% to about 1.0% by weight of said pulp fibers.

30. An antimicrobially-treated composite fabric as defined in claim 25, wherein said organosilicone antimicrobial agent comprises between  
20           about 0.2% to about 0.5% by weight of said pulp fibers.

31. An antimicrobially-treated composite fabric as defined in claim 25, wherein said continuous filaments are formed by a spunbond process.

32. An antimicrobially-treated composite fabric as defined in claim 25, wherein said pulp fibers comprises between about 60% to about 90%  
25           by weight of said composite fabric.

33. An antimicrobially-treated composite fabric as defined in claim 25, wherein said organosilicone antimicrobial agent comprises between about 0.03% to about 0.8% by weight of said composite fabric.

5 34. An antimicrobially-treated composite fabric as defined in claim 25, wherein said organosilicone antimicrobial agent comprises between about 0.16% to about 0.4% by weight of said composite fabric.

35. An antimicrobially-treated composite fabric as defined in claim 25, wherein said organosilicone antimicrobial agent is covalently bonded to said pulp fibers.

10 36. An antimicrobially-treated composite fabric as defined in claim 35, wherein the covalent bond formed between said organosilicone antimicrobial agent and said pulp fibers is a siloxane bond.